Issued December 7, 1911.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 472.

SYSTEMS OF FARMING IN CENTRAL NEW JERSEY.

BY

GEORGE A. BILLINGS,

AND

J. C. BEAVERS,

Assistant Agriculturists, Office of Farm Management, Bureau of Plant Industry.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1911.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., September 13, 1911.

SIR: I have the honor to transmit herewith and to recommend for publication as a Farmers' Bulletin the accompanying manuscript, entitled "Systems of Farming in Central New Jersey," prepared by Messrs. George A. Billings and J. C. Beavers, Assistant Agriculturists, of the Office of Farm Management.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

ILLUSTRATIONS.

B. P. I.—701.

SYSTEMS OF FARMING IN CENTRAL NEW JERSEY.

INTRODUCTION.

The section of which this bulletin treats is situated in the coastal plain region of central New Jersey. (Fig. 1.) It includes all of this region except the coarse sandy soils, which have not yet been profitably cultivated. The application of this bulletin, however, covers a large area, and the systems of farming outlined can probably be profitably followed on the clay and sandy clay loams in southern New Jersey, southeastern Pennsylvania, Maryland, and Delaware. According to the classification of the Bureau of Soils, the principal types of soil found here belong to the Norfolk, Collington, and Sassafras series. They vary from sandy loam and fine sandy loam to silt and clay loam. The lighter soils of the Norfolk series are more suited to the growing of early truck crops than to general types of farming. The fine sandy-loam soils are especially well suited to the growing of early potatoes and types of

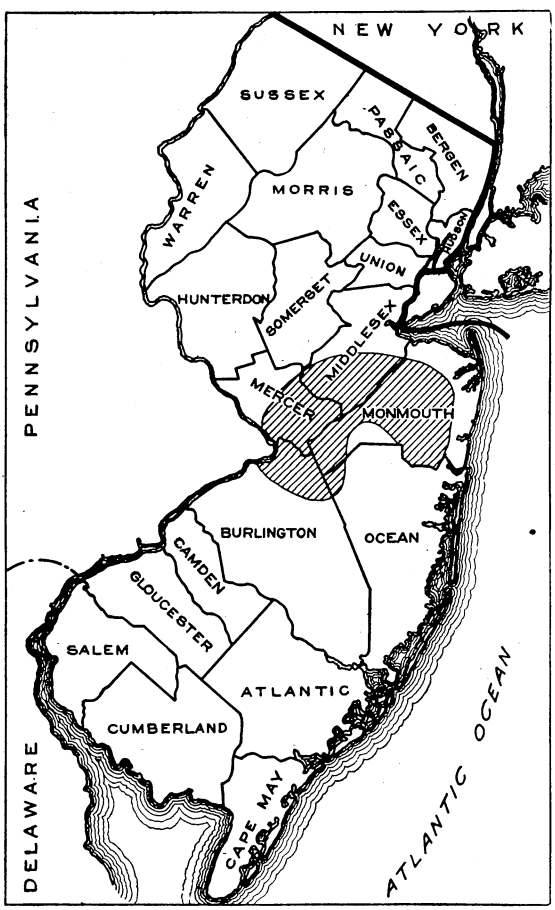

FIG. 1.—Map of New Jersey, showing the section described in this bulletin by means of linear shading.

general or specialized farming, while the silt-loam and clay-loam soils are adapted primarily to hay, grain, and dairy farming.

A study of Table I shows that the rainfall during the summer months is well distributed and is well suited to the types of farming in this section.

Table I also shows that the quantity and distribution of rainfall during the spring and early summer is especially well suited to the growing of potatoes, hay, and grain, which are the dominant crops over most of this area; also that the amount and distribution of the precipitation in August and September are well suited to the seeding of winter cover crops, grains, and grasses. This may in part account for the success farmers have attained in the growing of winter cover crops for soil improvement.

TABLE I.—*Precipitation in central New Jersey during the summer season of the years 1901–1910, inclusive.*

AVERAGE RAINFALL IN INCHES PER MONTH.

Month.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	10-year average.
April	6.36	3.31	4.66	3.47	2.97	3.25	3.94	3.14	6.31	4.09	4.15
May	5.44	1.99	.66	4.70	1.83	4.46	5.74	6.95	1.92	2.26	3.59
June	1.60	6.12	7.20	2.88	2.36	5.22	4.98	3.41	2.11	5.49	4.14
July	6.06	3.52	6.06	5.53	4.02	6.40	3.50	5.28	1.84	.62	4.18
August	3.62	3.61	6.11	9.52	4.20	8.02	3.72	6.26	6.08	5.03	5.62
September	2.31	4.25	3.23	4.81	5.04	1.03	6.91	1.51	3.15	1.86	3.41

NUMBER OF DAYS WITH MORE THAN 0.01 OF AN INCH OF PRECIPITATION.

April	10	6	9	10	11	8	12	10	13	11	10.0
May	14	5	5	9	6	10	11	12	7	13	9.2
June	5	12	13	13	10	11	10	3	11	13	10.1
July	13	13	12	13	12	14	8	9	4	5	10.3
August	11	9	12	10	12	13	12	9	8	10	10.6
September	4	15	6	7	8	5	14	2	7	7	7.5

Table II shows that the date of late spring frosts is subject to much variation. While the potato crop has not been seriously injured at any time, the late spring frosts have killed fruit buds, particularly where the air drainage is poor. During this nine-year period an early fall frost has occurred but once, a factor which is especially favorable to the growing of late forage crops.

TABLE II.—*Dates of killing frosts in central New Jersey in the years 1901–1910, inclusive.*

Season.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Last in spring	Mar. 31	Apr. 16	May 2	Apr. 23	May 2	May 11	May 12	Apr. 21	Apr. 25	May 6
First in fall	Oct. 25	Oct. 29	Oct. 25	Sept. 22	Oct. 22	Oct. 12	Oct. 22	Oct. 13	Oct. 13	Oct. 13

There are few sections in the United States where soil fertility and profitable farming have been so generally maintained as in central New Jersey, although the land has been farmed for more than 150 years. An account of the methods which have given such results can not fail to be of general interest because conservation of soil fertility is at the present time a problem which confronts farmers in practically all sections of the United States.

The soils, the climate, and the location render central New Jersey well adapted both to general and to specialized farming. While these natural advantages have added to the success of farming in this section, the intelligent use of manures, fertilizers, lime, and cover crops, and good farm management have had an important influence in making the farms productive and the farmers prosperous. This bulletin discusses the prevailing systems of farming and describes some of the methods followed by the more successful farmers in this region. It also gives suggestions based on a study of the agriculture of the region concerning cropping systems, the management of soils and crops, and the use of manures and fertilizers to maintain soil fertility. Data are given in detail for a typical farm, showing that the high-priced land in this section may be farmed at a profit.

The income and expenses for a 10-year period on this farm, which is a successful tenant farm of 175 acres, have been taken from records carefully made by the owner. The owner's net income shows that the farm has paid 7¼ per cent interest for 10 years on a valuation of $200 per acre. The tenant has operated the farm continuously on the share-tenant system for 13 years. During this time he has hired over half the labor, employed a housekeeper for a number of years, and has been able to save an average of $500 per year above all expenses. The records from this farm also show that the yield of crops has been considerably greater during the last five years than during the first five. Likewise, the net income has been increased 50 per cent during the last period as compared with the first, which shows that the productiveness of the soil has been maintained on a profitable basis.

CROPPING SYSTEMS OF CENTRAL NEW JERSEY.

The cropping systems in vogue in this section usually alternate money crops with feed crops, the rotations being arranged to furnish the proper kind and amount of feed for live stock with the most profitable market crops. Both the money and feed crops are often grown more than one year in succession, yet the rotation is arranged so that the humus supply in the soil is maintained. Even on the fields where potatoes are grown several years in succession the humus supply is kept up by the use of winter cover crops.

The farm income is chiefly from potatoes, wheat, or rye, and timothy hay, while dairy products, hogs, and poultry are of secondary importance. Potatoes have been profitably grown for a number of years, the soil, climate, markets, and other conditions being favorable for the growing of this crop. Furthermore, the cultural methods which have proved most profitable have been generally adopted. Few crops universally grown in this section require more intelligence in cultivating or marketing or bring a greater net profit year after year than potatoes, and the crop rotation is usually arranged to permit as large an acreage of this crop as possible.

Wheat is not grown to as great an extent as formerly. It is grown principally on soils unsuited to successful potato growing, and primarily to provide straw as bedding for live stock and as a crop in which to seed clover and grasses. The corn and the clover hay grown are usually fed to live stock, but timothy hay, which is grown to better advantage on the heavier soils, is usually marketed. At the present market prices timothy hay is even more profitable than grain. Hogs are kept chiefly to use up surplus skim milk, waste vegetables and fruit, and the scraps from the house. They are seldom pastured. Poultry is kept mostly for home supplies, except on the more sandy and consequently lower-priced lands, where this industry is prominent.

The preparation of the soil and the planting and cultivation of crops in this section are generally quite thorough. The growing of winter cover crops to improve soil fertility, the growing of legumes to furnish a protein food for live stock, the use of lime as a soil amendment, and the application of commercial fertilizers are quite well understood. One of the most important influences to bring about these results is the work of the New Jersey Agricultural Experiment Station. The station has kept in close touch with the farmers of this section, and through its influence farming conditions have been greatly improved. The influence of a few unusually successful farmers has also contributed to the improvement of farm practice.

THREE-CROP ROTATION SYSTEMS.

In districts where potato growing is prominent, a common cropping system is a 3-year rotation consisting of (1) corn, (2) potatoes, and (3) clover planted alone or with a little timothy. A part of the clover sod is sometimes planted to potatoes, followed the next year with potatoes; after digging this crop in August, the land is seeded to clover or clover and timothy. This 3-year rotation is often extended over a period of four or five years by seeding to clover and timothy after potatoes, cutting the clover the first year and timothy for one or two succeeding years. The outline of these rotations is presented in Table III.

TABLE III.—*Rotations suited to potato-growing districts.*

Year.	Rotation A (3 years).	Rotation B (3 years).	Rotation C (4 years).	Rotation D (5 years).
1	Corn[1]	Corn[1] (half area) and Potatoes[1] (half area)	Corn[1]	Corn[1] (half area). Potatoes[1] (half area).
2	Potatoes	Potatoes	Potatoes	Potatoes.
3	Clover	Clover	Clover and timothy	Clover and timothy.
4			Timothy	Timothy.
5				Do.

[1] Followed by a winter cover crop.

Very few farmers adhere strictly to any of the above rotations because of conditions which make it desirable to vary the cropping system. One principal reason for this variation is the desire to increase the acreage of potatoes. Fields which have soils most suitable for potatoes may follow a succession of crops as outlined under B. On the other hand, if the soil contains considerable clay and is therefore well suited to timothy, or if the farmer desires a smaller acreage of cultivated crops, then rotation C or D is followed. Hence two or more of the above rotations may be followed on different parts of the same farm.

In some cases potatoes are planted in succession for two or three years on that portion of the field which has soil well suited to the growing of this crop. The remainder of the field is kept in grass as long as the hay crop is profitable. Then follows corn, then wheat seeded with clover and timothy. Such a cropping system is much less convenient than a regular rotation. The inconvenience may be avoided where the soil conditions can be improved by subsoiling those areas which have a stiff clay subsoil and underdraining the wet areas. This method would do away with the necessity of planting different crops in the same field.

Several cases have been found where potatoes have been grown continuously for several years, three cases of continuous growing for 12 to 15 years, and the yields have been kept well up to the average. To so keep up the yield has been possible only by growing a winter cover crop of either wheat or crimson clover, or both, to be turned under the following spring as green manure. While such a system may be followed under certain conditions with apparent profit, it is very doubtful if continuous potato growing will be more profitable in a series of years than the systems outlined.

WINTER-COVER AND GREEN-MANURE CROPS.

It is generally the practice in central New Jersey to keep the ground covered with growing crops over winter to be plowed under in spring as green manure. It is thought that these crops prevent

the loss of plant food and the washing away of fine particles of soil. For this reason nearly all the plowing is done in the spring.

Wheat and crimson clover are the two principal crops used as winter cover crops. One or the other of these crops is almost universally sown in corn, which is to be followed by potatoes. Wheat is usually preferred to rye for late summer or early fall planting, but for later seedings rye can be used to better advantage, particularly on corn stubble. In several instances the growing of wheat or crimson clover, or both, as a winter cover crop between successive crops of potatoes, supplemented by the application of commercial fertilizer at the rate of 1,500 pounds per acre, has maintained the humus supply in the soil and has resulted in an average yield of 225 to 250 bushels of potatoes to the acre for several consecutive years on the same land. That farmers as a preparation for a potato crop will, in early spring, unhesitatingly turn under a crop of wheat which would make 25 to 30 bushels of grain per acre shows their confidence in this practice as essential in growing potatoes.

Wheat is seeded alone at the rate of 1½ to 2 bushels per acre from the 1st of August to the 10th of September. Crimson clover when sown alone is seeded at the rate of 12 to 18 pounds per acre between July 20 and August 20. Later seeding of crimson clover is much more likely to winterkill. Farmers more generally prefer to grow wheat, as the chances of success with this crop are greater than with crimson clover. Some farmers, however, prefer to seed both crops together, and the available data indicate that the mixture is better than either crop alone. By using the mixture a winter crop is practically assured, and there is at the same time a good chance for the crimson clover to make sufficient growth in the fall to enable the young plants to gather considerable nitrogen from the air. The mixture is usually seeded at the rate of 1 to 1½ bushels of wheat and 8 to 12 pounds of crimson clover to the acre.

On the more sandy soils of this section winter, or hairy, vetch has been grown with remarkable success as a winter-cover and green-manure crop. That this crop could be grown much more extensively on both sandy and sandy-loam soils is practically assured, provided inoculation is properly applied.[1] Vetch makes a successful cover crop with rye or wheat, with crimson clover, or with both grain and crimson clover. Vetch grows under more unfavorable conditions than crimson clover, but the addition of clover assists in making a thicker growth. (Fig. 2.)

The principal reason for growing rye or wheat with vetch and crimson clover is to insure a stand and to support the vetch. Farm-

[1] See "Progress in Legume Inoculation," Farmers' Bulletin 315, U. S. Dept. of Agriculture.

ers practice sowing a mixture of 2 to 3 pecks of rye, 18 to 20 pounds of vetch, and 5 to 6 pounds of crimson clover to the acre. When vetch and crimson clover are sown without the grain, 25 pounds of the former with 6 pounds of the latter are used, and 40 pounds of vetch seed when sowed alone. When crimson clover is omitted, from 2 to 3 pecks of grain with 20 to 25 pounds of hairy vetch are planted. On heavier soils wheat can be sown to advantage in place of rye in this mixture.

The winter cover crops grown in this section make practically all their growth in the fall, as they are usually turned under late in March or early in April, about the time spring growth starts. Wheat makes a growth of 4 to 6 inches in the fall, and crimson

FIG. 2.—A winter cover crop of hairy vetch. (From photograph taken late in the fall.)

clover from one-half to two-thirds as much. This illustrates quite plainly the incorrect idea many farmers have formed, namely, that in order to grow cover crops profitably it is necessary to allow them to reach full growth before turning under. There is no doubt that a cover crop seeded thickly and turned under when 4 or more inches high will bring as profitable a return from the following crops as 6 to 8 tons of the average barnyard manure. If legumes are used, nitrogen will also be added to the soil, and this will lessen the need for buying nitrogenous fertilizers.

THE USE AND CARE OF BARNYARD MANURE.

During the past 10 years the number of dairy cattle kept in this section has greatly decreased; consequently there is considerably less

manure for maintaining fertility than formerly. The decrease in the number of cattle was brought about by the fact that a few years ago the kind of cattle kept by the average farmer and handled in the ordinary manner became unprofitable. About this time other products of the farms, especially potatoes, advanced in price and many farmers abandoned cattle and took up branches of farming that gave a greater profit. Considerable barnyard manure, however, is still produced, most of which is spread at the rate of 10 to 18 tons per acre on sod land during the winter and early spring and turned under for corn. In some instances where farmers live within 2 or 3 miles of town they furnish livery stables or individuals with straw for bedding for the manure produced, and this manure as well as that produced on the farm is practically all used for corn. Occasionally a farmer may be found who uses a part of his manure on second-year or third-year hayfields, applied in fall or early winter. Manure spread with a spreader is much more effective than if spread by hand, for two reasons: (1) Hand-spread manure, on account of being more lumpy, is more in the way at haying time and (2) the more even distribution by the spreader produces a more uniform growth of crop and a better utilization of the manure.

The wasteful practice of throwing the manure into the open barnyard, where it remains for several months exposed to the weather, is only too common even in this well-farmed section. It is gratifying to be able to say that it is not universal. Manure heaps exposed to the weather for four months during winter and early spring lose at least 40 per cent of their value. This loss may be largely prevented by carting the manure to the field daily and spreading it where it will leach into the soil, where it is wanted, or by keeping it under a shed having a cement bottom, where the cattle compact it so that little decomposition and loss of nitrogen in the form of ammonia take place. The addition of acid phosphate or ground phosphate rock to the manure in the stable at the rate of 1 pound per day for each animal, or mixing 40 pounds of it with each ton of manure as the manure is taken from the stables, aids greatly in retaining the nitrogen and also improves the quality of the manure, since phosphoric acid is nearly always needed in this section. Both the Pennsylvania and the Ohio experiment stations [1] have shown conclusively that it is better practice to apply small quantities of manure frequently than to apply the same bulk in one application.

The increase in yield of crops from moderately light applications, say 6 to 8 tons per acre, is much greater per ton of manure applied than where large quantities are used at a single application, and farm-

[1] Bulletin 90, Pennsylvania Agricultural Experiment Station; and Bulletin 183, Ohio Agricultural Experiment Station.

ers who apply lighter applications at shorter intervals get better results from a given amount of manure than those who make heavier applications at longer intervals.

THE USE OF LIME.

From about 1885 to 1895 the use of lime in central New Jersey was quite prevalent. From 1895 to 1900 the acreage planted to potatoes greatly increased. During this period farmers learned from observation and experiment that potatoes grown on land which had received an application of lime within 1 or 1½ years of the time of planting were badly affected with scab, while those grown on land which had not been limed in recent years were practically free from scab. This condition caused farmers to cease using lime. During the 10 years following practically no lime was used, and farmers began to notice that the yield of crops, especially clover and grass, were gradually declining; in fact, the clover crop was quite often a failure on land which had not received lime for 10 years or more. This failure of clover caused farmers to think that lime was again needed. They began applying lime in different quantities under various conditions and found that moderate applications of lime could be made three or more years before a crop of potatoes was planted without danger of increasing scab and with decided benefit to clover and grass. Since that time lime has been used more extensively.

Applications of 1,000 to 1,500 pounds to the acre of burned stone lime or oyster-shell lime, or approximately twice as much unburned finely ground limestone, may be used profitably about every four to six years. There is little doubt that unburned ground limestone is one of the best forms of lime to use on these sandy-loam soils, but the use of lime in this form will largely depend upon its cost price. The efficiency of unburned ground limestone also depends upon the fineness to which it is ground.

The most suitable time to apply lime in rotations, including potatoes, is when preparing land for wheat or hay following potatoes and corn, or as a top-dressing on young clover and grass. Regardless of the kind of lime used, great care should be used to spread it thoroughly and evenly over the land. The best results can not be had from lime unevenly spread and left to lie in lumps. The most practical method is to have the lime thoroughly fined and to spread it with a lime or fertilizer distributor. Burned stone lime may be spread in this way if water is applied slowly in slaking, no more being used than is necessary to crumble the lumps. As stone lime nearly always has a few small stones intermixed, it is well to run it through a sand sieve before spreading.[1]

[1] See "The Liming of Soils," Farmers' Bulletin 77, U. S. Dept. of Agriculture.

THE USE OF COMMERCIAL FERTILIZERS.

The maintenance of productive soils and profitable farming on the high-priced land in this section is due largely to the intelligent use of commercial fertilizers. This statement does not mean that reliance on fertilizers alone has been the means of maintaining high crop yield, but that the judicious use of fertilizers in rotation systems, whereby the humus supply of the soil has been steadily maintained, has been the means of keeping the farm lands in this section so productive. Further details of local farm practice in the use of commercial fertilizers are given under the different crop headings.

METHODS OF CULTURE WITH CORN.

Plowing for corn or other early spring crops usually begins about March 20, or as early as the weather and soil conditions will permit. The object of plowing early is to allow the soil to be thoroughly compacted by spring rains so that the sod or stubble turned under may decay readily and good capillary circulation of soil moisture

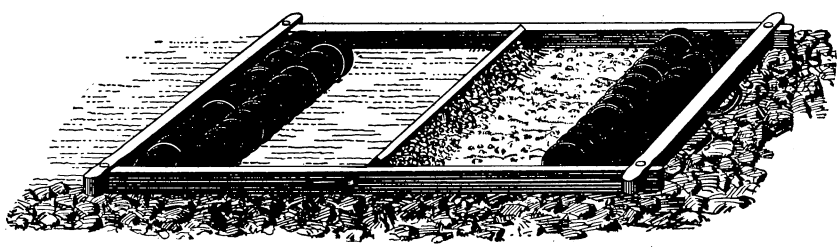

FIG. 3.—A smoothing harrow for use immediately after plowing and to be followed by the pulverizing harrow.

become established. Sod for corn or potatoes is plowed from 6 to 9 inches deep. Where the topsoil is shallower than this it may be deepened by turning up one-half to 1 inch or so of subsoil at each plowing. The field is rolled or planked immediately after plowing to level the soil for harrowing and to prevent clod formations. Instead of rolling many farmers prefer to use a small, square seeding or smoothing harrow, such as is shown in figure 3. The field is then disk harrowed, lapping half in order to keep the field level, cross harrowing if necessary, until the soil is fine and pulverized. The disk harrow is followed by a spike-toothed or other smoothing harrow. (Fig. 4.) The use of the spike-toothed harrow is repeated every week or 10 days, especially after a rain, until the time of planting. If the soil is loose and dry the field should be rolled again and the roller should be followed with a light harrow to prevent evaporation.

Manures and fertilizers.—Practically all of the barnyard manure is applied to the corn crop. The rate of application usually ranges

from 10 to 15 tons per acre, depending upon the available supply. One successful farmer, whose fields yield 75 to 80 bushels of corn to the acre, never plows under manure even on sod, but spreads it in the spring after plowing and disk harrows it under.

When 10 or more tons of manure are applied to the acre, most farmers in this section consider it unnecessary to apply commercial fertilizer except on very poor land or where corn follows corn. Where fertilizer is used for corn, a few farmers follow the practice of applying to this crop 300 to 500 pounds of fertilizer containing 3 to 4 per cent of nitrogen, 8 to 10 per cent of phosphoric acid, and 10 per cent of potash. Other farmers appear to be getting as good results with corn by applying a fertilizer containing 2 to 3 per cent of nitrogen, 8 to 10 per cent of available phosphoric acid, and 4 to 6 per cent of potash, especially in connection with an application of 8 or more

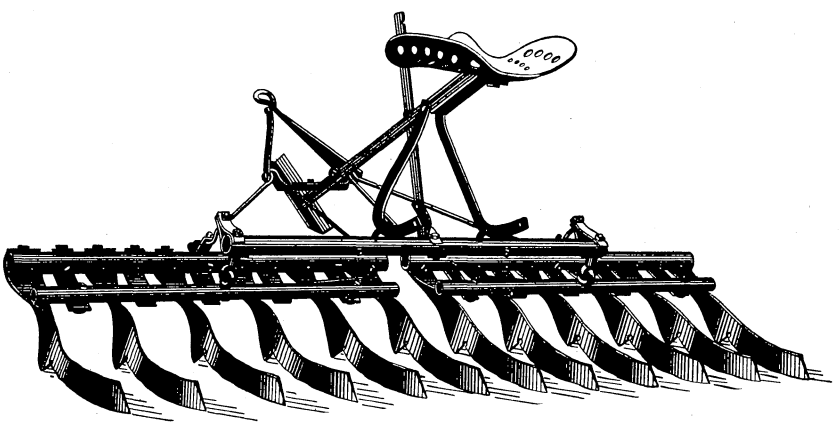

FIG. 4.—Harrow for smoothing and leveling the soil behind the plow.

tons of barnyard manure. Where either crimson clover or hairy vetch, or both, are turned under as green manure, the practice among successful farmers who plant winter cover crops for green manure indicates that as good yields of corn are obtained as from an application of 8 to 10 tons of barnyard manure. Moreover, where these green-manure crops are regularly grown the nitrogen in the commercial fertilizer may be considerably reduced, if not entirely omitted.

Mr. Sidney Burge, of Monmouth County, has been growing hairy vetch as a winter cover crop on sandy soil with considerable success. His first trial was after rye, which had been pastured, planting 3 pecks or more of vetch seed per acre. A good growth of vetch was turned under the following May and the field then planted to corn. A portion of this area, which was in onions the previous year, was not planted to vetch, but all other conditions in respect to farm prac-

tice were the same. Where vetch was turned under as a green-manure crop, an increase of 75 bushels of ears of corn per acre was due to its influence.

In 1910 this same gentleman compared the plowing under of winter vetch and crimson clover with an application of barnyard manure at the rate of about 20 tons to the acre. The vetch and crimson clover were planted at the rate of 40 pounds of seed of the former to 7 pounds of the latter, and the yield of corn from the green manured plat was 33 bushels of ears per acre more than the plat receiving a heavy application of barnyard manure.

On fields where no manure or green-manure crops are turned under, from 300 to 500 pounds to the acre of the fertilizers shown in Table IV have been profitably used in this section.

TABLE IV.—*Fertilizer mixtures for corn on different soils.*

Mixture.	On sandy and sandy-loam soils.				On clay-loam soils.			
	Quantity.	Nitrogen.	Phosphoric acid.	Potash.	Quantity.	Nitrogen.	Phosphoric acid.	Potash.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Nitrate of soda (15.5 per cent nitrogen)	200	31	.....	.....	200	31	.....	.....
Tankage (5 per cent nitrogen, 12 per cent phosphoric acid)	1,100	55	132	.....	1,000	50	120	.....
Acid phosphate (14 per cent phosphoric acid)	450	.....	63	.....	600	.....	84	.....
Muriate of potash (50 per cent potash)	250	.....	.....	125	200	.....	.....	100
Total	2,000	86	195	125	2,000	81	204	100
Percentage analysis	.....	4.3	9.75	6.25	.....	4.0	10.2	5.0

Small quantities of fertilizers may be distributed through the fertilizer attachment on the corn planter, but large quantities are more satisfactorily applied with a drill or a fertilizer distributor.

Planting and cultivation.—The common practice is to use a corn planter which distributes fertilizer, if desired, and plants two rows at a time in drills or in checks. The old method, which is followed by some good farmers, is to mark off the rows in both directions, planting in the checks either by hand or with a hand planter.[1] When planted in checks from 3½ to 4 feet each way about four kernels are dropped to the hill; when planted in drills one kernel is dropped at intervals of 12 or 15 inches, the object being to grow about three stalks to every 3½ feet of row. Where the corn is grown for grain, 5 to 6 quarts of seed, depending upon the size of the kernel, will plant an acre; but 7 to 9 quarts is the customary rate for planting silage corn.

[1] This method is most economical when only small areas are to be planted. Just how many acres of corn will justify the purchase of a corn planter is a question on which the Office of Farm Management is working.

No special attention is given, as a rule, to the selection of seed corn. Most farmers here, as elsewhere, select the seed from the crib. A much better practice, however, and one which is followed by a few good farmers in this section, is to make the selection in the field before the crop is harvested. For a full account of the details of this method of selection the reader is referred to bulletins published by the United States Department of Agriculture.[1]

When the corn begins to prick through the ground, or even before, the field is worked with a weeder or a spike-toothed harrow with the teeth set backward at an angle of about 30°. The object of working the field at this time is to kill any small weeds that may be coming through, and the operation is repeated if necessary until the corn is tall enough so that the cultivator can be used. Cultivation with a 2-horse riding cultivator having 2-inch hoes and a fender to keep the dirt from covering the plants usually begins when the corn is from 3 to 4 inches tall. Cultivation continues every 10 days to two weeks, the width of the hoes on the machine often being increased at each working. The last cultivation is with a single cultivator going twice in the row about the time the tassels appear. Cover crops are usually planted at this time and immediately covered with a spike-toothed cultivator. If the cover crop is not planted at this time, or if the one planted fails, rye may be sown after the corn is cut. If the cutting is done early in September, wheat and hairy vetch may be sown and they will make good growths before winter.

One successful farmer works his field with a riding cultivator before the corn comes up, letting it dig into the soil as deeply as possible, but not run very near the rows. He follows immediately with a weeder and continues with this implement until the corn gets large enough to cultivate. Later cultivations alternate with the use of the weeder. Some farmers remove the weeder teeth that come directly over the row so that the implement may be used until the corn gets 12 to 18 inches tall. It is very desirable to practice deep cultivation early, but all subsequent cultivation should be shallower. The last cultivation should merely scratch the ground and make a dust mulch. Keep the weeds away, but do not disturb the roots of the growing crop.

Harvesting.—The corn is cut and shocked by hand or cut with a corn harvester, as soon as the grains have become hard. Where the corn is to be followed by wheat it is the practice to place the rows of shocks much farther apart than customary to facilitate the drilling of wheat. As soon as the corn is hard and dry, husking is done in the field by hand and the corn is then hauled to the cribs. The corn stover is placed in large shocks until it is dry enough to be hauled to the barn or stacked near the barnyard.

[1] Farmers' Bulletins 193, 229, and 415, U. S. Dept. of Agriculture.

In this section climatic conditions are such that it is impracticable for farmers to use a corn husker and shredder in the fall, as the stalks are often green until late fall or winter and the shredded fodder molds before it can be fed out. A better practice is to cut the stover into 3-inch or 4-inch lengths every week or 10 days during the winter.

METHODS OF CULTURE WITH POTATOES.

When potatoes are not planted on sod land the prevailing practice is to turn under a winter cover crop for green manure. In either case the land is plowed to a depth of 8 to 10 inches, rolled, disk harrowed, and the preparation finished with a smoothing harrow as explained for corn. (Fig. 5.)

FIG. 5.—Disk harrowing after leveling a recently plowed field.

Manures and fertilizers.—The potato crop seldom receives an application of barnyard manure, but instead a green-manure crop such as wheat, rye, or crimson clover, or a sod is turned under. Manure, as well as lime, often makes soil conditions favorable to the development of the fungus which causes potato scab, and for this reason it is not applied when preparing land for potatoes. The decay of the previous applications of manure and the decomposition of the sod or winter cover crop turned under furnish sufficient humus. The turning under of a good sod or a green manure tends to prevent the development of the scab fungus.

Potatoes are never grown in this section without commercial fertilizer. This crop usually receives an application of 1,200 to 1,500

pounds of a fertilizer containing 4 per cent of nitrogen, 8 per cent of phosphoric acid, and 8 to 10 per cent of potash. Table V shows one of the most common formulas in this section for heavy loam and light clay soils.

TABLE V.—*Fertilizers for potatoes on heavy loam or light clay soils.*

Mixture.	Quantity.	Nitrogen.	Phosphoric acid.	Potash.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Nitrate of soda (15.5 per cent nitrogen)	200	31	.....	.....
Dried blood (12 per cent nitrogen)	200	24	.....	.....
Tankage (8 per cent nitrogen, 6 per cent phosphoric acid)	300	24	18	.....
Steamed bone meal (1 per cent nitrogen, 16 per cent phosphoric acid)	200	2	32	.....
Acid phosphate (14 per cent phosphoric acid)	780	.....	109	.....
Muriate of potash (50 per cent potash)	320	.....	.....	160
Total	2,000	81	159	160
Percentage analysis	.....	4	8	8

On the light loam and sandy soils the potash should be increased to 10 per cent, which would require that 400 pounds of muriate of potash be used in the formula given above. Several experiments have been reported showing the superior quality of potatoes grown with sulphate of potash instead of muriate of potash, and in a few instances the sulphate has given a marked increase in yield over the muriate. Unless the cost of sulphate is excessive this form of potash should be more generally used for potatoes. Where a cover crop of crimson clover or vetch is turned under, the nitrogen in the formula above may be profitably reduced 1 per cent.

Planting and cultivation.—Planting usually begins between April 1 and April 10, or when the soil is warm and in condition. The work is done with a 2-horse potato planter, which marks the rows, drops the seed, distributes the fertilizer, and covers the potatoes at one operation. The rows are placed 32 to 34 inches apart, and the potato pieces approximately 15 inches apart in the row. The fertilizer is usually distributed in the row, but often when 1,500 pounds to the acre is applied 500 pounds is drilled broadcast and the remainder distributed with the planter. Occasionally a part of the fertilizer is used as a side application during the growing season. The potato planter should be regulated to drop the potatoes in the bottom of the furrow and allow them to be covered lightly with soil before the fertilizer is applied, so that the fertilizer and the potatoes will not come in contact, otherwise the tender potato roots may be injured. Lack of observance of this precaution accounts for a good many poor stands of potatoes.

Very few farmers plant home-grown seed potatoes in this section. Experience has shown that northern-grown seed has greater vitality

and usually produces an earlier crop, both of which are important factors in the production of potatoes for early market. The American Giant is the principal variety grown. It is a long, coarse potato, poor in quality, but a prolific yielder. The main bulk of the crop is shipped to the mines of Pennsylvania and to factories which make Saratoga chips and French-fried potatoes. These potatoes sell in the market at a lower price than the Irish Cobbler and Green Mountain varieties, but the larger yield usually makes the American Giant variety more profitable.

The seed is practically all cut by hand to about two eyes to each piece; that is, a medium to large potato will be cut in four to six pieces. Considerable judgment must be used in order to get a uniform piece which will pass through the planter and contain the right number of eyes. Often a portion of the ends is discarded. The amount of seed used per acre varies from 4½ to 6 barrels, or an average of 14 bushels. The depth of planting varies from 1½ to 3 inches.

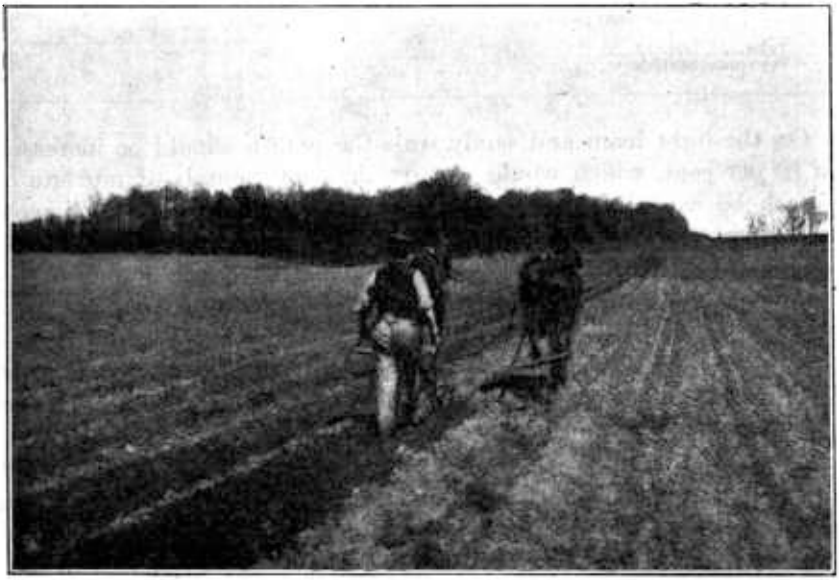

FIG. 6.—Cultivating potatoes for the first time.

Cultivation begins a few days after planting or immediately after a rain and before the potato plants appear. A riding cultivator or, what is more commonly used at this time, a 1-horse cultivator (fig. 6) set narrow and going once between the rows, but using two horses by means of a long evener, is the implement used. At the first cultivation the aim is to work the soil as deeply as possible, or from 7 to 9 inches. This cultivation is immediately followed

by a spike-tooth harrow or a weeder, whichever tool is most efficient for leveling the field. This is continued until the potatoes are tall enough for cultivating. The riding cultivator is thereafter run through the field every week until the tops begin to close in between the rows. The depth of cultivation is shallower each time. It is of advantage in cultivating this crop to alternate with the cultivator and the weeder, taking out two or more of the weeder teeth which come over each row. The last working is made with a 1-horse cultivator, taking off all the regular teeth and putting on a wide point. This throws a little dirt against the row to prevent the starting of crabgrass, which often becomes troublesome at the time of digging.

Poisons are applied as soon as the potato beetles or slugs are numerous enough to damage the crop, and further applications are made as often as necessary. It is seldom necessary to apply Bordeaux mixture for blight on early potatoes in this section. Paris

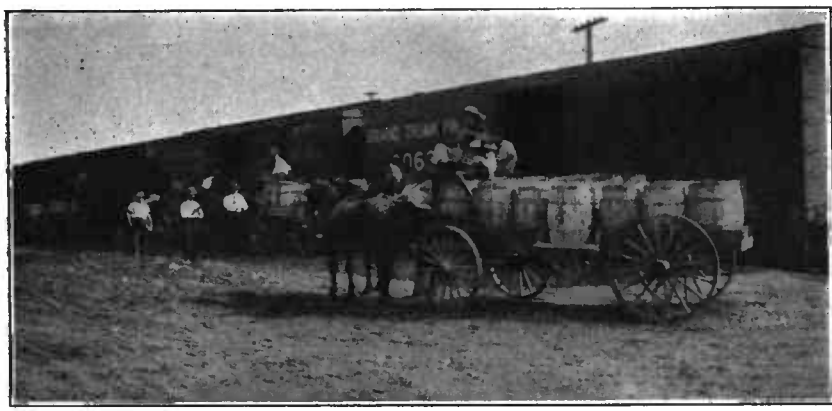

FIG. 7.—Wagon holding 16 barrels used for hauling potatoes.

green is more commonly used than any other poison. It is usually applied dry without mixing with any other material, by means of a power blower which is drawn by one horse and which covers four rows at one time. The amount of Paris green used each time is from 3 to 4 pounds to the acre; 30 acres can be covered in one day.

Harvesting.—Digging begins early in August, or as soon as the vines have matured. The elevator potato digger drawn by four horses is the type of machine generally used, and the plan is to keep the digger just a few rows ahead of the pickers so that the potatoes may dry and yet not sunburn. The potatoes are usually sold by the barrel of 165 pounds, but are shipped in bulk. It is customary to pick up two rows of potatoes at one time and put them into flour barrels, the pickers receiving 5 cents per barrel. A special wagon body (fig. 7) holding 16 barrels is used in hauling potatoes to the cars.

The average yield of potatoes in this section for 1910 was between 85 and 95 barrels (250 to 280 bushels) per acre, but the season was exceptionally favorable. The average yield for a series of years has been about 80 barrels (236 bushels) to the acre. One successful farmer reports a yield of 144 barrels (425 bushels) of American Giant potatoes to the acre from a 9-acre field.[1] (Fig. 8.)

METHODS OF CULTURE WITH CLOVER AND TIMOTHY.

Clover and timothy are usually seeded with wheat and the method followed is described under that heading (pp. 9–10). The first year the hay contains a large proportion of clover, but the following season the clover disappears and the hay harvested is practically clear timothy, which is one of the most profitable crops on medium to heavy loam soils in this section. Timothy is a soil exhauster, and commercial fertilizers or barnyard manure, or both, are necessary as top-dressings when this crop is kept in sod for two or more years.

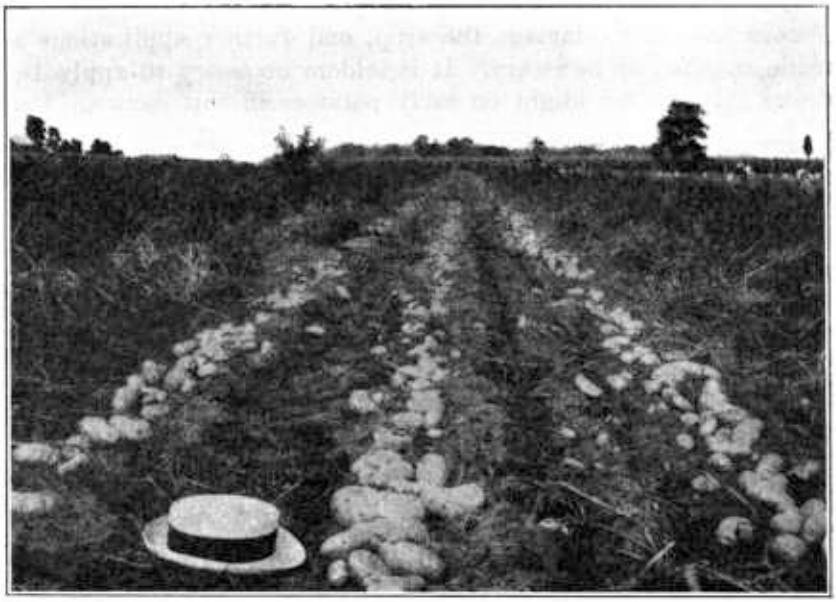

FIG. 8.—A crop of American Giant potatoes.

A mixture of clover and timothy is very successfully seeded in August after harvesting potatoes. When this is done the vines are raked and carted off and the soil is harrowed lightly, yet enough to make a good seed bed. It is not safe to plow or even to harrow deeply such land in dry seasons, because of the difficulty of getting the soil compacted sufficiently to insure good moisture conditions.

[1] For detailed information on potato culture the reader is referred to Farmers' Bulletins 35, 91, 210, 225, 251, 320, 365, and 407, U. S. Dept. of Agriculture.

A corrugated roller is useful at such times. The practice of seeding timothy and clover alone (wheat omitted) in August is quite successful in Pennsylvania, New Jersey, Maryland, Virginia, and the States north and west of these. Farther south and west this practice has not been so successful.

Some farmers are putting a little alfalfa into the clover and timothy mixtures, not only for the purpose of inoculating the soil and finding out whether alfalfa will grow successfully but also to provide a second and often a third cutting of hay. One farmer is getting good results by seeding potato ground immediately after digging the potatoes to a mixture of 4 pounds of alfalfa, 4 pounds of alsike clover, 9 pounds of timothy, and 12 pounds of red clover. A seeding made in 1909 gave the following year three cuttings, a total of 3 to 4 tons of hay per acre. The first cutting had a large proportion of timothy, the second cutting was mostly clover, and the third cutting nearly all alfalfa. This seeding will not make a permanent alfalfa meadow, but the alfalfa usually inoculates the soil, and the sod turned under at the end of the season or the following spring increases the humus and nitrogen in the soil and furnishes good conditions for a crop of corn or potatoes to follow.

Many farmers allow their new seedings to become foul with weeds, which stock the land with seeds that may germinate years afterwards. To prevent this some farmers clip the clover on wheat stubble in August and leave these clippings on the field as a mulch. This practice keeps the weeds and young clover from maturing seed, shades the young grass roots, thickens the sod, and helps retain the moisture.

Fertilizer is seldom applied to the first crop of hay, as that applied at the time of seeding wheat is usually considered sufficient. When the clover and timothy mixture is seeded alone after a heavily fertilized crop of potatoes, hay may be cut for two seasons without further application of fertilizer. When the hay crop is seeded with wheat it usually pays to fertilize the second year's crop of hay. Table VI presents one of the formulas used for top-dressing timothy on sandy-loam and silt-loam soils.

TABLE VI.—*Top-dressing for timothy meadows on sandy-loam and silt-loam soils.*

Mixture.	Quantity.	Nitrogen.	Phosphoric acid.	Potash.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Nitrate of soda (15.5 per cent nitrogen)	1,000	156	.....	.....
High-grade tankage (10 per cent nitrogen)	400	40	24	.....
Acid phosphate (14 per cent phosphoric acid)	400	.....	56	.....
Muriate of potash (50 per cent potash)	200	.....	.....	100
Total	2,000	196	80	100
Percentage analysis	.....	9.8	4.0	5.0

This mixture is applied at the rate of 300 pounds to the acre with a broadcast fertilizer distributor about the middle of April. On heavy clay soils the potash could be reduced advantageously to half that given in the formula, as clay and clay-loam soils are usually well supplied with this fertilizer constituent. This mixture should be applied on a bright day when there is no moisture on the grass.

The best time to apply barnyard manure as a top-dressing for hay is in the fall or early winter. Later applications are too much in the way in haying time, and the fertilizing constituents do not dissolve sufficiently to enable the hay crop to get the full benefit of the manure. When the manure is applied in the fall it serves as a mulch and in this way greatly benefits the sod.

CROPPING SYSTEMS INVOLVING THE SMALL GRAINS.

The acreage planted to grain, including wheat, rye, and oats, has greatly decreased during the last 20 to 30 years, and oats are now seldom grown for grain on any part of the coastal plain of New Jersey, as local climatic conditions are unfavorable to the profitable production of this crop. The reduction in the acreage of wheat and rye is about in proportion to the decrease of the live-stock industry and dairying. The primary reason for this decrease is the fact that potato growing has become more profitable than grain growing and live-stock farming. This statement holds true not only in central but also in southern New Jersey.

Since the seeding of clover and timothy after digging potatoes in August is giving fully as good if not better results than seeding with wheat or rye, the growing of grain is largely confined to those areas where potatoes are not so successfully grown and especially to farms which make the dairy the principal source of income. In some sections, particularly on the sassafras-loam and silt-loam soils, rye is even more profitable than wheat. The rye crop is often sold from the field, without thrashing, to straw-baling concerns. Occasionally clover and timothy are seeded in August after disking the wheat or rye stubble; but this practice is not common, since there is a tendency for grain to shatter and self-seed to the detriment of the quality of the hay.

Table VII presents rotations, including wheat, practiced by successful farmers in this section. Rye may be substituted for wheat in any of these rotations.

TABLE VII.—*Rotations which include wheat for potato-growing districts in central New Jersey.*

Year.	Rotation E (4 years).	Rotation F (4 years).	Rotation G (5 years).	Rotation H (6 years).
1	Corn[1]	Corn[1] (half area) Potatoes (half area)	Corn[1]	Potatoes.[1]
2	Potatoes	Potatoes	Potatoes	Corn.[1]
3	Wheat	Wheat	Wheat	Potatoes.
4	Clover	Clover	Clover and timothy	Wheat.
5			Timothy	Clover and timothy.
6				Timothy.

[1] Followed by a winter cover crop.

These rotations combine forage with grain crops. Rotations F and H give decided prominence to potatoes, G and H to timothy hay as a market crop, while all of them are well adapted to dairy farming. When a considerable number of live stock is kept, corn may follow corn, potatoes being omitted. Rotation G would thus become (1) corn for grain, (2) corn for silage, (3) wheat, (4) clover and timothy, and (5) timothy. Rye in place of wheat is better on poorly drained soils because of less danger of winterkilling, and rye is usually a profitable market crop in New Jersey.

Rotation H is not so common, but is strongly recommended by a few successful farmers who follow it. The first crop of potatoes planted on sod is harvested in August, the vines are raked off, and the field, without plowing, is seeded to crimson clover and wheat. This cover crop has the benefit of the residual plant food applied to the potatoes, and when turned under the next spring is beneficial to the corn crop which follows. Likewise a similar cover crop is sown in corn at the last cultivation for the benefit of the following crop of potatoes. The wheat is sown after potatoes are harvested. Timothy is sown at the time the wheat is drilled, and the clover is sown the following March.

The live-stock farming based on these rotations not only has the advantage of the use of barnyard manure, but the rotations provide in addition winter cover crops as green manure, both of which increase the supply of humus in the soil and thus make the application of commercial fertilizers for potatoes profitable both for that crop and for the crop of wheat which follows.

METHODS OF CULTURE WITH WHEAT.

Wheat is sown after potatoes or corn. In either case one double disking and one or two harrowings with a drag harrow put the ground in splendid condition for this crop. Seeding of wheat is usually done from September 25 to October 10. About 1¼ bushels of wheat and 4 quarts of timothy are sown to the acre. As the season advances the quantity is increased to 1½ or 1¾ bushels of wheat and 6 quarts of

timothy. From 4 to 6 quarts of clover, of which generally three-fourths is red clover and one-fourth alsike, is sown in the spring between February 20 and March 15, when the soil is in that peculiar state due to repeated alternate freezing and thawing which farmers call "honeycomb" condition.

Wheat is harvested with a self-binder, shocked, and as soon as dried sufficiently for storing is hauled to the barn or stacked in the field. It is important to harvest and stack the wheat at the proper time, otherwise there is shattering of seed. If the farm is of good size, it may pay to own an equipment for thrashing, but more often this work is contracted for with outside parties.

Where wheat follows potatoes, fertilizers are seldom used for the wheat. The heavy application of fertilizer applied to potatoes leaves residual fertilizer in the soil, after growing this crop, sufficient to grow a crop of wheat and the first crop of hay that follows. When wheat follows corn and the ground is seeded to clover and timothy to remain in sod for one or more years, an application of 200 pounds of acid phosphate, 200 pounds of bone meal or 400 pounds of basic slag, and 100 pounds of high-grade tankage to the acre brings profitable returns. Some farmers simply use 300 to 400 pounds of bone meal. On light loamy and sandy soils from 20 to 40 pounds of muriate of potash in addition to the above may be used with good results. As a rule potash is not necessary on heavy clay soils in this section.

LIVE STOCK AND DAIRYING.

Most of the farmers in central New Jersey keep only a few cows, primarily of the dairy breeds, to convert into manure the roughage of the farm. Dairy farming is carried on to a limited extent near the large centers and along the lines of railroad where the products, principally milk, are easily marketed. Where but little milk is produced it is generally used in producing veal calves. Many of the cows are of the ordinary type and are not profitable when feeds are charged at market prices; but they utilize a large amount of roughage which could not otherwise be worked into manure to advantage. They also graze low ground or rough lands which could not be planted profitably to any crop.

Several farmers find it profitable to keep a small, well-bred herd of cows, selling the milk wholesale at the farm. On some of these farms the very limited pasturage is supplemented by soiling crops, such as early rye or wheat, crimson clover, Canada peas and oats, cowpeas, alfalfa, and fodder corn. On other farms which have no pasture, corn silage or clover or alfalfa hay are fed throughout the year, with corn stover as additional roughage in winter. These farmers make dairying profitable because (1) they keep good cows;

(2) the milk produced is from healthy cows, is handled in a cleanly manner, and is always in demand at good prices; (3) leguminous crops, such as clover, alfalfa, and the like, form an important part of the cropping system and greatly decrease the feed bill.

ALFALFA ROTATION SYSTEMS.

While alfalfa is not grown to any great extent in central New Jersey, a few farmers have grown this crop successfully and the results show that on the coastal plain of New Jersey, except on the more sandy soils, this crop can be grown with profit if the farmer carefully follows the methods of culture suggested by the experience of the most successful growers. Alfalfa has been grown from five to seven years without reseeding with an average annual yield of 4 to 6 tons of field-cured hay per acre. When reseeding is necessary, the sod is plowed in the fall, planted to potatoes the following spring, and seeded to alfalfa again in August immediately after the potatoes are dug. Corn is also a very profitable crop after alfalfa. A rotation containing corn, potatoes, and alfalfa is a very practical one for this section, since it is profitable with or without live stock. An outline of some of the rotations which include alfalfa is presented in Table VIII.

TABLE VIII.—*Rotations which include alfalfa for farms in central New Jersey.*

Year.	Rotation I (6 years).	Rotation J (6 years).	Rotation K (7 years).	Rotation L (4-crop rotation).			
				Field 1.	Field 2.	Field 3.	Field 4.
1	Potatoes	Corn [1]	Corn for grain [1]	Alfalfa	Corn [1]	Potatoes	Clover.
2	Alfalfa	Potatoes [1]	Corn for silage [1]	do	Potatoes	Clover	Corn.[1]
3	do	do	Canada peas and oats for hay.	do	Clover	Corn [1]	Potatoes.
4	do	Alfalfa	Alfalfa	do	Corn [1]	Potatoes	Alfalfa.
5	do	do	do	Corn	Potatoes	Clover	Do.
6	do	do	do	Potatoes	Clover	Corn [1]	Do.
7			do	Clover	Corn [1]	Potatoes	Do.
8				Corn	Potatoes	Alfalfa	Do.
9				Potatoes	Clover	do	Corn.

[1] Followed by a winter cover crop.

In these rotations the soil fertility is maintained or increased by the use of barnyard manure for corn, by winter cover crops as green manure after corn and also after the first crop of potatoes in rotation J, and by the application of commercial fertilizers for potatoes or as a top-dressing for alfalfa. Early potatoes are a good crop to precede alfalfa, since good tillage and the elimination of weeds are important factors in the preparation for the alfalfa crop. It will seldom be necessary to use commercial fertilizer in seeding down to alfalfa after potatoes where the potato crop has had a liberal application, but where alfalfa is seeded after Canada peas and oats an application of the mineral fertilizers is strongly recommended.

The above rotations are soil builders rather than soil exhausters, and the productiveness of the soil may be maintained with them by the addition of mineral fertilizers. The decaying alfalfa roots and stubble and the cover crops turned under will satisfactorily maintain the humus content of the soil.

Rotation I has been profitably followed on a well-drained gravelly clay soil, and the potatoes following five years of continuous alfalfa yielded in 1910 between 250 and 300 bushels of tubers. Moreover, the new seeding of alfalfa, after the potatoes were dug in August, was one of the best seen that season. Rotation J is well adapted to the needs of the farmer who keeps a small herd of dairy cows, as it furnishes two crops of potatoes and one or two crops of alfalfa as money crops and one crop of corn, besides alfalfa, as feed crops. Rotation K will furnish feed in a better proportion for the specialized dairy type of farming. The type of rotation of which L is an example is strongly suggested on farms where only one or more fields have suitable soil for alfalfa. With this rotation alfalfa is grown continuously as long as it does well and is then transferred to some other field. This system is adapted to the needs of the general farmer who wishes alfalfa hay for horses and a few cows.

When dairy farming is followed on a large scale, which necessitates the planting of 50 to 100 acres of silage corn, it is often impossible to plan a rotation where the silage corn will be convenient every year for hauling to the silos. There will be more economical handling of forage crops in such cases if the land near the silos is divided into two fields of equal area, letting alfalfa grow on one field five or more years while the other field remains in silage corn. At the end of this period Canada peas and oats for forage or early potatoes may follow the silage corn and the field then be seeded to alfalfa, while silage corn will be planted on the other field. The exchange of crops—that is, the transition from corn to alfalfa—may more conveniently cover a period of two or three years. Silage corn may profitably be planted continuously for five or more years in this section with annual applications of manure. This, however, would not be a safe practice in regions where the soil is infested with the corn root aphis or the corn rootworm.

In the study of the gross incomes from rotations including alfalfa the figures show a marked increase over the gross incomes from the other rotations discussed in this bulletin, and as the acreage of cultivated crops is even less than the corresponding areas in the other rotations the net incomes must show fully as large an increase.

It must not be thought, however, that since alfalfa on a well-managed farm is so profitable, a person with little experience in farming or a farmer who is a poor manager and obtains only low

average yields of farm crops can rush into this system of farming with any assurance of success. It is far better for such farmers to learn how to grow clover successfully and begin with alfalfa on a small scale, not over an acre or more, until experience has taught the proper methods to follow. As a rule, those who are the most observant, who are best informed on the requirements of soils and crops, and who practice the most careful methods of tillage are having the best results with alfalfa, as they do with other crops. It will save time and discouragement if those who contemplate starting to grow alfalfa or those who have tried and failed will profit by the experience of those who have successfully grown this crop in this section.

METHODS OF CULTURE WITH ALFALFA.

This crop can safely follow early potatoes or Canada field peas and oats for hay in central and southern New Jersey, planting the alfalfa between August 15 and September 5. Where it is necessary to plow in preparation for the crop it should be done early in July in order to harrow every week or 10 days to destroy weeds and compact a firm seed bed. What has been said about seeding clover and timothy in August applies to this crop, but in order to get alfalfa well established one must be very thorough in the preparation of the soil and in seeding. Exceptionally good stands are obtained in this section after potatoes, in which case plowing is unnecessary.

Alfalfa will not do well on an acid soil and lime must be applied in larger quantities than for any other crop. Where oats and peas precede alfalfa, the application of lime can be made in the spring to advantage. When alfalfa follows potatoes the lime must be applied after the potatoes are harvested. Apply at the rate of 2 tons of burned stone lime or 1 ton of burned stone lime and 2 tons of unburned ground limestone, or 4 to 5 tons of unburned ground limestone when used alone. In whatever form lime is used it should be harrowed in very thoroughly. Inoculation for alfalfa is generally necessary here and may be done by applying from 400 to 600 pounds of sifted topsoil from a well-established alfalfa field by means of a drill or fertilizer distributor, or by hand. It is important to protect this inoculating soil from exposure to the sun before harrowing it in, as sunlight may destroy the bacteria. When inoculated soil is not available special cultures may be used, and some growers use both culture and soil. These special cultures may be obtained from the United States Department of Agriculture.[1]

MANURES AND FERTILIZERS FOR ALFALFA.

If the soil is lacking in humus, manure can be applied with advantage the year before seeding to alfalfa or to the previous crop grown

[1] For further details relating to inoculation for alfalfa, see Farmers' Bulletins 194, 339, and 374, U. S. Dept. of Agriculture.

the same year. Green-manure crops may take the place of barnyard manure. Where 1,200 to 1,500 pounds of fertilizer are applied to the potato crop preceding, it may not be necessary to use any commercial fertilizers for alfalfa at the time of planting. When alfalfa is not seeded after potatoes, an application of 300 pounds of acid phosphate, 150 pounds of bone meal, and 100 pounds of muriate of potash to the acre is advisable. A top-dressing of 250 pounds of acid phosphate and 50 pounds of muriate of potash applied after the first cutting every succeeding year also brings profitable returns.

HARVESTING ALFALFA.

The value of alfalfa hay depends largely upon the care taken in harvesting the crop. Where the hay is exposed to the sun's rays until the leaves are brittle, the most nutritious part of the hay is lost in handling. The best method is to dry alfalfa in the swath until the plant is well wilted, but before the leaves become brittle the hay should be raked and cocked. The cocks are not disturbed for two or three days. On the day the hay is ready to be hauled to the barn the cocks are opened to the sun and air for about two hours. If it rains, the hay must be spread out and dried in the usual manner and then recocked. It may be necessary during a long storm to move the cocks to prevent killing the alfalfa plants underneath.

In growing alfalfa in central New Jersey hay caps are to be recommended. Farmers who use them state that the increased value of the hay and the greater convenience in handling the crop when hay caps are used is sufficient to justify the expense. They are made of heavy cotton muslin, about 45 inches square, and are weighted at each corner. Where alfalfa is grown on a large scale, some farmers cure the hay in windrows, keeping it constantly turned with a side-delivery rake.

A SUCCESSFUL TENANT FARM UNDER THE FOUR-CROP SYSTEM.

In order to show the financial returns on the high-priced farm land in this section, a farm was selected having conditions as nearly typical as possible in respect to soil, type of farming, and cropping system, and at the same time having records for a long period of time. The tenant farm described below fulfills these conditions, with the possible exception that the soil is a little heavier than on the majority of farms in this section.

This farm was purchased by the present owner in 1868 for $150 per acre. It was necessary for the purchaser to go heavily in debt when the purchase was made. This debt was paid gradually by the sale of products from the farm. In 1896 the owner had accumulated

sufficient wealth to enable him to retire from active farm life and move to a very comfortable home in town. When the owner made the change, one of the men who had been employed on the farm as a laborer for several years rented the farm. He had saved up $1,000, and had to go into debt about $2,000 more for work stock, farm machinery, etc. The tenant has remained on the farm continuously since that time, and has by careful management not only maintained crop productiveness but has made the farm profitable to both owner and tenant. (Fig. 9.)

The farm in every respect presents a neat and attractive appearance. The large, well-arranged buildings are kept in order and repair, and the trim lawns, good fences, and neat fence rows produce a pleasing effect. One of the most noticeable things about the farm

FIG. 9.—Farmstead of a successful tenant farm.

and buildings is the absence of weeds, which so often detract from the appearance of a farmstead.

RELATION BETWEEN LANDLORD AND TENANT.

The tenant owns all the farm machinery and work stock, and all of the productive live stock is owned jointly by landlord and tenant. The landlord pays for all repairs and improvements, for all lime and manures purchased, and for three-fifths of the fertilizer. The amount expended for seeds, spraying material, and the like is shared equally. The tenant furnishes all of the labor. The net proceeds from the sale of all farm crops, live stock, and dairy products are divided equally. The live stock are fed from the undivided crops, except that grain for the work horses is furnished by the tenant from

his share of the corn crop. In addition to the above the tenant gets all the milk and butter necessary for family use, and both he and the landlord get all their potatoes and fruit in season from the farm.

THE PLAN OF THE FARM.

The farm is situated 1½ miles from the village, and contains about 175 acres. A township road crosses the farm near one end, and the farm buildings are centrally located on this road. The arrangement of the fields and the location of the farm roads, buildings, and dwellings are well planned and convenient. (Fig. 10.) Opposite the barns is a farm lane running at right angles to the highway, which gives access to all the fields on that side of the farm. Conveniently located on this lane are two large hay barracks. The permanent pasture is well suited to growing hay or grain and may be planted to any of these crops if it becomes necessary to cultivate the land for one year and reseed to pasture grasses.

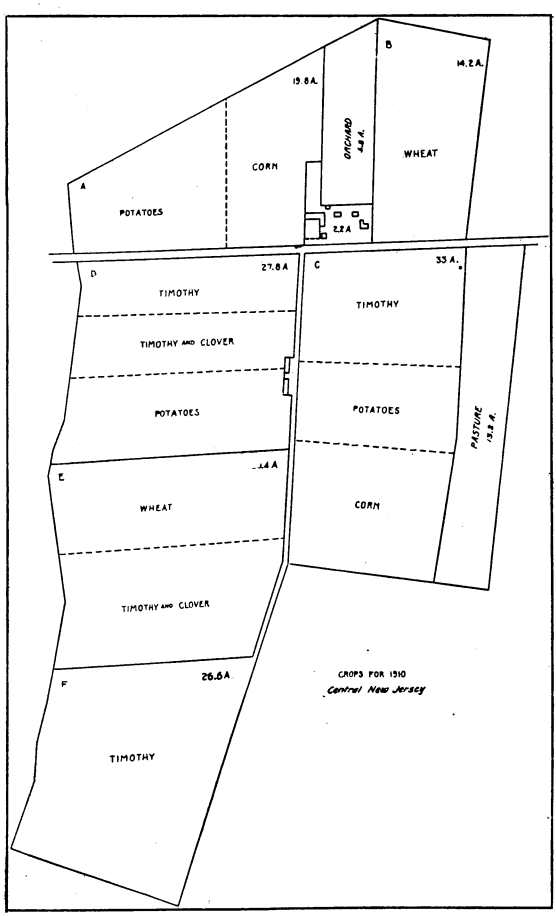

FIG. 10.—Diagram of a successful tenant farm.

THE SOIL.

The soil of this farm is a loam; according to the classification of the Bureau of Soils it is probably Collington sandy loam associated with Norfolk silt loam. The natural drainage of the fields is good except for a few small areas. All the fields have a gently rolling surface which drains naturally to two small streams, one forming the west boundary on one side of the farm and the other forming a partial boundary on the other side. A part of field F (fig. 10) is low, but here the drainage has been improved by the use of tile

underdrains. The drainage of sunken and flat places in other fields has also been greatly improved by the same means. On portions of several fields the clay comes within 6 inches of the surface, and on account of the shallow surface soil and rather poor drainage such places are not suited to the growing of potatoes. A more thorough system of tile drainage and an occasional subsoiling would probably greatly improve the production of these areas.

THE CROPPING SYSTEM FOLLOWED.

It is the aim on this farm to have a definite rotation. But the rotation has to be more or less varied (1) because the fields vary in area and the rotation has to vary in order to get the same annual

FIG. 11.—A hay loader in action on a successful tenant farm.

acreage of crops and (2) because portions of some of the fields have soils that are better adapted to the growing of corn, wheat, and hay than of potatoes. The general practice has been to grow from 20 to 25 acres of corn, 25 to 32 acres of potatoes, 20 to 25 acres of wheat, with the remainder of the land, about 75 acres, in hay. The area of sod broken each year is about equal to the area seeded to clover and grass. The general rotation has been (1) corn, (2) potatoes, (3) wheat, (4) clover and timothy, and (5) timothy. Portions of some fields are quite unsuited to the growing of potatoes; therefore, in order to get the desired acreage of this crop, occasionally a part of the timothy sod is turned under for potatoes and the remainder put into corn. The following year this whole field is planted to potatoes, thus giving potatoes two years in succession

on parts of the farm. On field F and portions of fields A and C the rotation has been (1) corn, (2) wheat, (3) clover and timothy, (4) timothy, and (5) timothy. Thus it is seen that the cropping system followed on this farm is a combination of rotations arranged to give about the same area of the different crops each year on soil well suited to the growing of each. It sometimes happens by this practice that the area of wheat will be greater than desired. If so, the potato ground is seeded to clover and timothy instead of to wheat. The cost of producing hay is reduced by using a good type of labor-saving machinery, such, for example, as the hay loader shown in figure 11.

LABOR AND EQUIPMENT.

The tenant keeps three men besides himself throughout the year, and one extra man from April 1 to November 1; that is, outside of his own labor, one man for each team during the working season. Four work teams are required on this farm in order to get work done in season, which means about one man and team for every 37½ acres of cultivated crops, grain, and meadows, or for about each 20 acres of cultivated crops and grain.

The farm buildings consist of one large storage and stock barn, two hay storage barns, one fertilizer and seed storage building, corn-cribs, and tool sheds. The inventory of the farm tools and live stock is presented in Table IX.

TABLE IX.—*Inventory of tools and live stock belonging to the tenant.*

Number.	Item.	Value.	Total.
	Farm tools.		
5	Wagons, two-horse, at $75 each	$375.00	
1	Spring wagon, one-horse	45.00	
4	Sets double harness, at $25 each	100.00	
1	Set single harness	20.00	
1	Set light double harness	30.00	
1	Platform scale, movable	10.00	
1	Fan, hand-power	9.00	
1	Corn sheller, hand-power	3.50	
1	Vegetable or root chopper	4.00	
1	Wheelbarrow	2.00	
1	Road drag, two-horse	3.00	
1	Fertilizer drill	1.00	
2	Potato wagon bodies, at $15 each	30.00	
3	Hay shelvings, at $15 each	45.00	
1	Wheelbarrow seed sower	5.00	
2	Fertilizer riddles, at $1 each	2.00	
1	Fertilizer distributor, at $15, half interest	7.50	
1	Roller or clod crusher, at $8, half interest	4.00	
1	Wheat drill, at $75, half interest	37.50	
1	Paris green dusting cart, at $40, half interest	20.00	
1	Corn harvester, six years' use	75.00	
1	Wheat binder, eight years' use	70.00	
1	Potato planter, two-horse	40.00	
1	Potato digger, four-horse	65.00	
3	Breaking plows, two-horse, at $7 each	21.00	
1	Turning and slicing harrow, three-horse	10.00	
1	Spring-tooth harrow, two-horse	10.00	
2	Disk harrows, two-horse, at $16 each	32.00	
1	Lever drag harrow, two-horse	5.00	
2	"A" harrows, two-horse, at $11 each	22.00	
4	Cultivators, one-horse, at $3 each	12.00	
3	Cultivators, two-horse, at $30 each	90.00	
			472

TABLE IX.—*Inventory of tools and live stock belonging to the tenant*—Contd.

Number.	Item.	Value.	Total.
	Farm tools—Continued.		
2	Mowers, two-horse, at $38 each	$76.00	
1	Hay tedder, two-horse	30.00	
1	Hayrake, two-horse, dump	15.00	
1	Hayrake, two-horse, side-delivery	65.00	
1	Hay loader	65.00	
3	Hayforks, for elevating hay in barn, at $8 each	24.00	
	Rope for hayforks	10.00	
			$1,490.50
	Small tools, etc		100.00
	Live stock.		
8	Horses, at $200 each		1,600.00
	Farm stock owned jointly by landlord and tenant.		
10	Head of cattle, at $40 each, half interest	200.00	
3	Brood sows, at $20 each, half interest	30.00	
1	Boar, at $25, half interest	12.50	
			242.50
	Tenant's total investment		3,433.00

The list of farm tools is very complete and the tools are kept in good repair. The list may be taken as fairly representative of what is required in this type of farming. Very few articles could be dispensed with without inconvenience except the corn binder, now seldom used. Corn is cut and shocked by hand, because the tenant believes the hand method to be the more economical. The cost of equipment, outside of buildings, on this farm is seen to be about $23 per acre of tilled land (150 acres). The capital invested in implements and machinery amounts to $10.60 per acre, that invested in work stock $10.65 per acre, and in other stock $2.62. The system of farming does not require the keeping of large power machinery.

INCOME AND EXPENSE.

Table X gives the income and expense of the landlord, as taken from his books, for the 10-year period from 1900 to 1909, inclusive.

TABLE X.—*Income and expense for 10 years, 1900 to 1909, inclusive.*

Item.	1900	1901	1902	1903	1904
Income:					
Potatoes	$615.32	$1,695.00	$1,262.90	$929.57	$1,389.74
Hay	604.43	780.97	484.10	684.95	732.85
Wheat	162.34	169.90	196.00	274.40	313.50
Live stock	486.47	375.85	496.08	453.58	453.92
Boarding horses			75.00	38.50	70.70
Miscellaneous (fruit, corn, etc.)	52.50	13.90	285.50	107.03	53.98
Total	1,921.06	3,035.62	2,799.58	2,488.03	3,014.69
Expense:					
Seeds	109.65	111.62	93.29	141.63	150.00
Live stock	55.00	29.50	38.50	45.62	95.00
Fertilizer	484.20	538.20	696.55	444.00	420.00
Miscellaneous (lime, Paris green, feed, etc.)	15.68	10.36	16.14	136.20	26.00
Total	664.53	689.68	844.48	767.45	691.00
Net profit	1,256.53	2,945.94	1,955.10	1,720.58	2,323.69

TABLE X.—*Income and expense for 10 years, 1900 to 1909, inclusive*—Continued.

Item.	1905	1906	1907	1908	1909
Income:					
Potatoes	$1,233.44	$1,450.00	$2,993.77	$2,194.65	$1,514.93
Hay	384.17	889.37	1,007.96	1,095.34	977.28
Wheat	212.50	323.23	316.35	313.90	362.87
Live stock	528.43	472.92	526.48	361.72	444.49
Boarding horses	75.00	125.42	167.20	433.19	367.32
Miscellaneous (fruit, corn, etc.)	39.00	272.06	305.41	315.66	255.00
Total	2,472.54	3,533.00	5,317.17	4,714.46	3,921.89
Expense:					
Seeds	172.45	138.25	180.50	236.30	189.51
Live stock	47.00	43.75	39.50	104.50	39.25
Fertilizer	420.00	447.75	477.75	479.96	686.52
Repairs (buildings, fence, tile, etc.)	.....	.....	243.00	.....	120.00
Miscellaneous (lime, Paris green, feed, etc.)	528.25	33.50	154.00	17.40	119.73
Total	1,167.70	663.25	1,094.75	838.16	1,155.01
Net profit	1,304.84	2,869.75	4,222.42	3,876.30	2,766.88

In addition to the receipts shown in Table X the landlord has received sufficient feed from the farm to board two horses, which at average farm prices for 10 years would be worth $110 per horse, or $220 for the two horses for each year. The additional perquisites which the owner receives from the farm are probably worth $30 per year, which makes the additional income equivalent to $250 per year. Against this must be charged the farm taxes and insurance, which averages between $170 and $180 per year. Deducting $180 for taxes and insurance from $250, the value of perquisites, there is left $70, which should be credited to the farm income.

The valuation of the 175-acre farm at present is $35,000. During the 10-year period, of which account is given, the average net profit to the landlord has been $2,524.20, besides perquisites to the amount of $70 or more. This gives an interest of 7¼ per cent per annum on a valuation of $200 per acre.

No accurate account of the net income of the tenant farmer is available, except that for the 13 years he has operated the farm he has been able to save $500 per year after paying all expenses. He has brought up a family, and for the greater part of this period he was required to hire a housekeeper.

In studying the detail of expenses of both the landlord and tenant for seeds, fertilizer, and lime, some interesting figures have been deduced. During the 10 years the average cost of seed potatoes necessary to plant the average crop has been $244.48, or about $8.50 per acre planted. It has been necessary to spray for potato bugs with Paris green 7 of the 10 years, and the average annual cost of materials has been $34.30, or about $1.25 per acre sprayed, for the years in which spraying was done.

Commercial fertilizer has been one of the big expenses on this farm, and it is interesting to note that the average annual expense for this purpose has been $849.13, or an average of $5.66 for each acre in cultivation. The cost of grass and clover seed has averaged $54.40 per year, or about $2.50 to the acre of grass sown.

Lime has not been used on the farm every year, but since its use has become more prevalent there has been a marked improvement in the yield of crops, especially of clover and timothy. In 1903, $118 was expended for lime; 1905, $449; 1907, $124; and 1909, $119.73, which makes an average expense of $115.82 for each of the seven years since the use of lime was resumed, including years when no lime was used.

SUGGESTIONS FOR REARRANGING THE CROPPING SYSTEM.

This farm could be handled more economically if 6 acres of field A nearest to the buildings and 5 acres at the rear end of field C, both areas of heavy soil, were separated and farmed under the same cropping system as field F. Let A, which would then consist of 14 acres, and B, containing 14 acres, be planted to the same crop, thus becoming one 28-acre field in the rotation; C would also contain 28 acres. This would give four divisions of equal area, A and B, C, D, and E, which could be farmed under a 4-year rotation such as (1) corn, (2) potatoes, (3) wheat, and (4) clover and timothy. Perhaps a better rotation, since the farm records show that timothy hay will yield from 2 to 3 tons per acre, would be (1) corn, (2) potatoes, (3) clover and timothy, and (4) timothy. The 11 acres cut off from A and C, with the 26½ acres in F, should hardly be handled in a fixed rotation. These fields can be made to produce good crops of hay for three years by top-dressing, and at the end of this period, or whenever a part of the field fails to make a satisfactory yield, it should receive an application of manure and be prepared and planted to corn. At the last working of corn, wheat and hairy vetch should be planted. The following spring this crop may be pastured, fed green, or cut for hay, and the land prepared and planted to cowpeas the first of June. These cowpeas may be plowed under the last week in August or the first week in September and the field planted to wheat and seeded to clover and timothy in the usual way late in September or early in October. If this were done the soil should be well compacted after turning under the cowpeas in order to provide a firm seed bed for the wheat and grass.

If the heavy areas in A and C can be drained and subsoiled so as to make these portions suitable for growing potatoes, another suggestion for the changing of the rotation for more economical handling of the fields is presented in Table XI.

TABLE XI.—*Rotation of crops suggested for a New Jersey farm.*

Year.	Field A.	Field B.	Field C.	Field D.	Field E.	Field F.
1	Corn	Corn (half area) Hay (half area)	Hay	Potatoes	Wheat	Hay.
2	Potatoes	Potatoes	Corn	Wheat	Hay	Do.
3	Wheat	do	Wheat (half area) Potatoes (half area)	Hay	do	Corn.
4	Hay	Hay	Potatoes	do	Corn	Wheat.
5	do	do	Wheat	Corn	Potatoes	Hay.

By this arrangement it would not be necessary to plant two different crops in any one field except two years out of five, and this would much simplify the cropping system. It would require that field F be in hay three years in succession, while field B and part of C would be in potatoes two years in succession, which system is practiced in this region with success. In the first case timothy fields will produce profitable crops of hay for that length of time by top-dressing with commercial fertilizers; in the second case potatoes may be grown in succession, provided a cover crop is turned under to furnish humus to the soil.

SUMMARY.

(1) The part of the coastal plain of New Jersey described in this bulletin contains considerable farm land valued at $150 to $200 per acre, and 30 to 50 per cent of this land is let out on the share-tenant system.

(2) The farm buildings are substantial and in good repair, the premises neat and attractive, and the farmers generally prosperous.

(3) The section is conveniently located with reference to good markets, and the prices received for general and special farm products are sufficient to give the farmer a profitable income.

(4) The systems of farming followed in this section are profitable and well suited to the soil, market, and climatic conditions. The majority of farmers get their income from such money crops as potatoes, wheat or rye, and timothy or mixed hay. Of this income at least 50 per cent is from potatoes. Not over one-third of the farmers sell grain, and a large part of the corn and clover is fed to live stock.

(5) The live stock in this section is limited to work stock, dairy cattle, hogs, and poultry. Only a few farmers make dairying the principal type of farming; on most farms dairy cattle are kept so that the roughage on the farm may be fed. Hogs are kept only to a limited extent, and poultry is not an important industry except on the poorer sandy soils.

(6) The most common rotation is corn, potatoes, and hay, covering a period of three to six years, in which potatoes often are grown continuously for two or three years, followed by clover and timothy

seeded in August, after the potatoes are dug; or else potatoes are grown one year and clover and timothy are cut for hay two or three years. Where wheat is grown the crop usually follows potatoes, clover and timothy being seeded in the grain.

(7) The success of farming in this section is due largely to the intelligence of the farmers, as evinced by thoroughness in plowing, in preparing the soil, and in the cultivation of crops.

(8) The productiveness of the soil is maintained by the application of barnyard manure once during a rotation of three to six years, by winter cover crops after corn or potatoes (to be turned under as green manure early in the spring), and by supplementing these manures with commercial fertilizers, particularly for the potato crop.

(9) Wheat is more commonly sown as a cover crop at the last cultivation or immediately after cutting corn. Crimson clover is sometimes sown with the wheat, but more often it is sown alone in corn or after potatoes. Winter vetch is sown either alone or mixed with crimson clover or grain, or both. The use of vetch on sandy to medium sandy soil is quite satisfactory. The use of green manures to improve soil conditions has been an important factor in the successful growing of potatoes.

(10) The use of commercial fertilizers at the rate of 1,200 to 1,500 pounds per acre for potatoes has been profitable, and 300 to 500 pounds of fertilizer for corn, without manure, has brought profitable returns. A top-dressing of 300 pounds of fertilizer on timothy sod has given a profitable increase in yield of hay. Most farmers use home mixtures of commercial fertilizers, or they purchase the materials cooperatively and have large quantities mixed at some place centrally located.

(11) Alfalfa has been profitably grown by a few farmers. The growing of this crop should be encouraged, but in beginning farmers should plant a small area until their experience teaches them how to grow the crop.

(12) The financial statement from a representative farm in this section conducted on the share-tenant system shows clearly that young men without much capital may profitably conduct a tenant farm in this section.

(13) The average net income to the owner of a 175-acre tenant farm for a period of 10 years averaged $2,524.90 annually. This gives the owner an interest of 7¼ per cent on a valuation of $200 per acre. The tenant during this period has been able to save an average of $500 or more annually.

(14) The 10-year records of this farm show that the average cost of seed potatoes has been $8.50 and of Paris green $1.25 per acre of this crop. The average cost of commercial fertilizer has been $5.66

per acre in all crops (not including pasture), while grass and clover seed has cost $2.50 per acre seeded to this mixture.

(15) A more carefully laid farm plan, the rearrangement of fields in order to save labor and establish a more definite rotation, and the growing of more legumes, either as cover crops or as a regular farm crop, are the principal suggestions for this section.

472

O